



Los Angeles  
Bridge LED  
lights – 85%  
saving

Super-efficient fridge –  
80+% savings



# Transforming our Built Environment: strategies for new and existing buildings

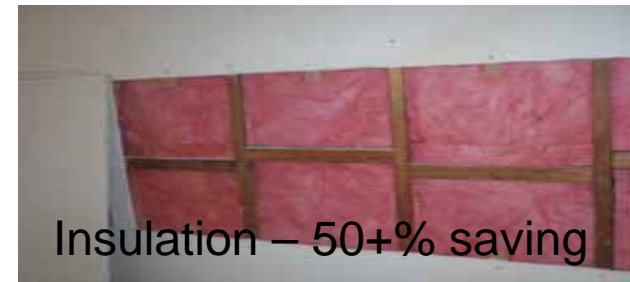


60L Green  
Building – 70%  
saving

Adjunct Prof Alan Pears AM October 2009  
Associate Director RMIT Centre for Design  
Director, Sustainable Solutions P/L

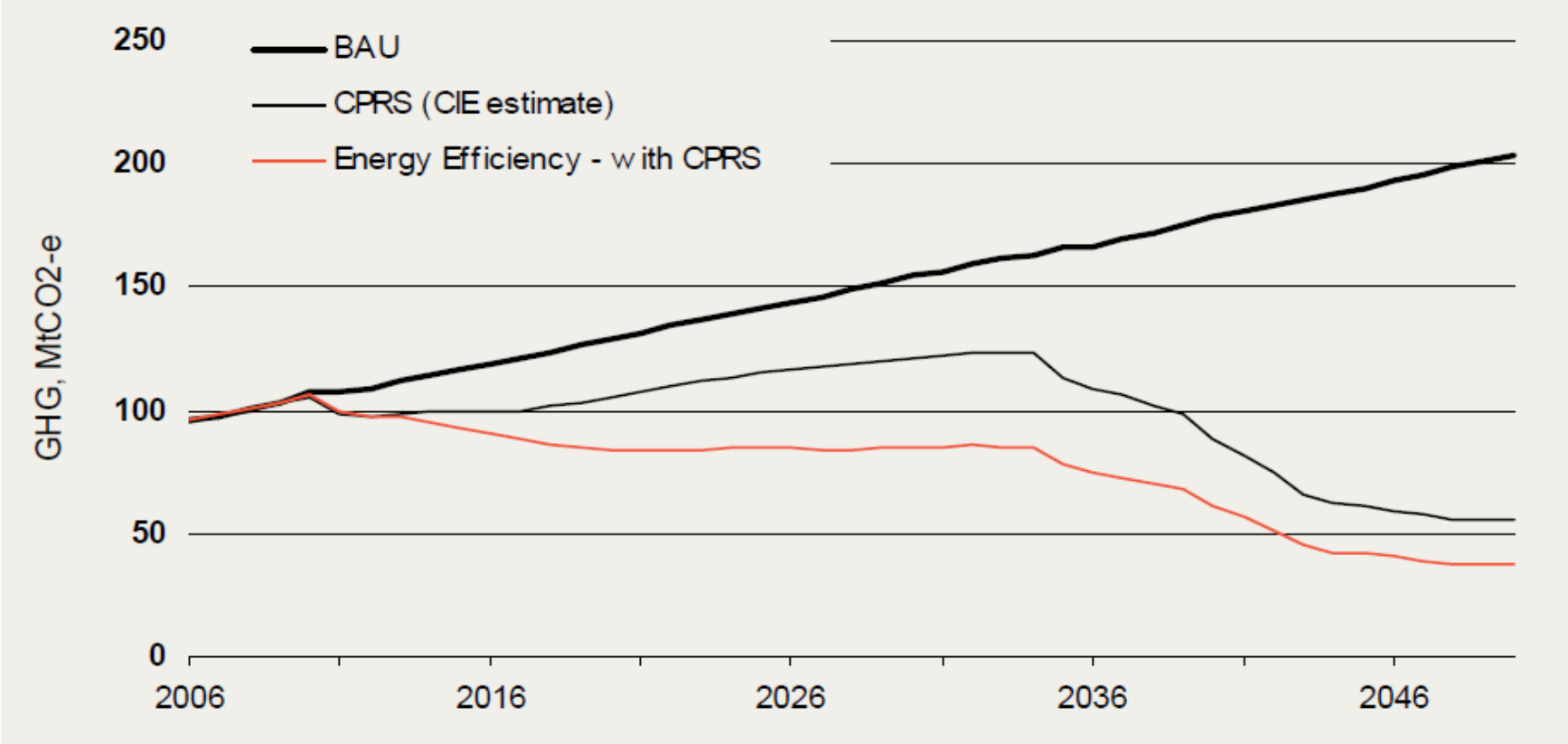


Compact fluorescent  
lamp – 80% saving



Insulation – 50+% saving

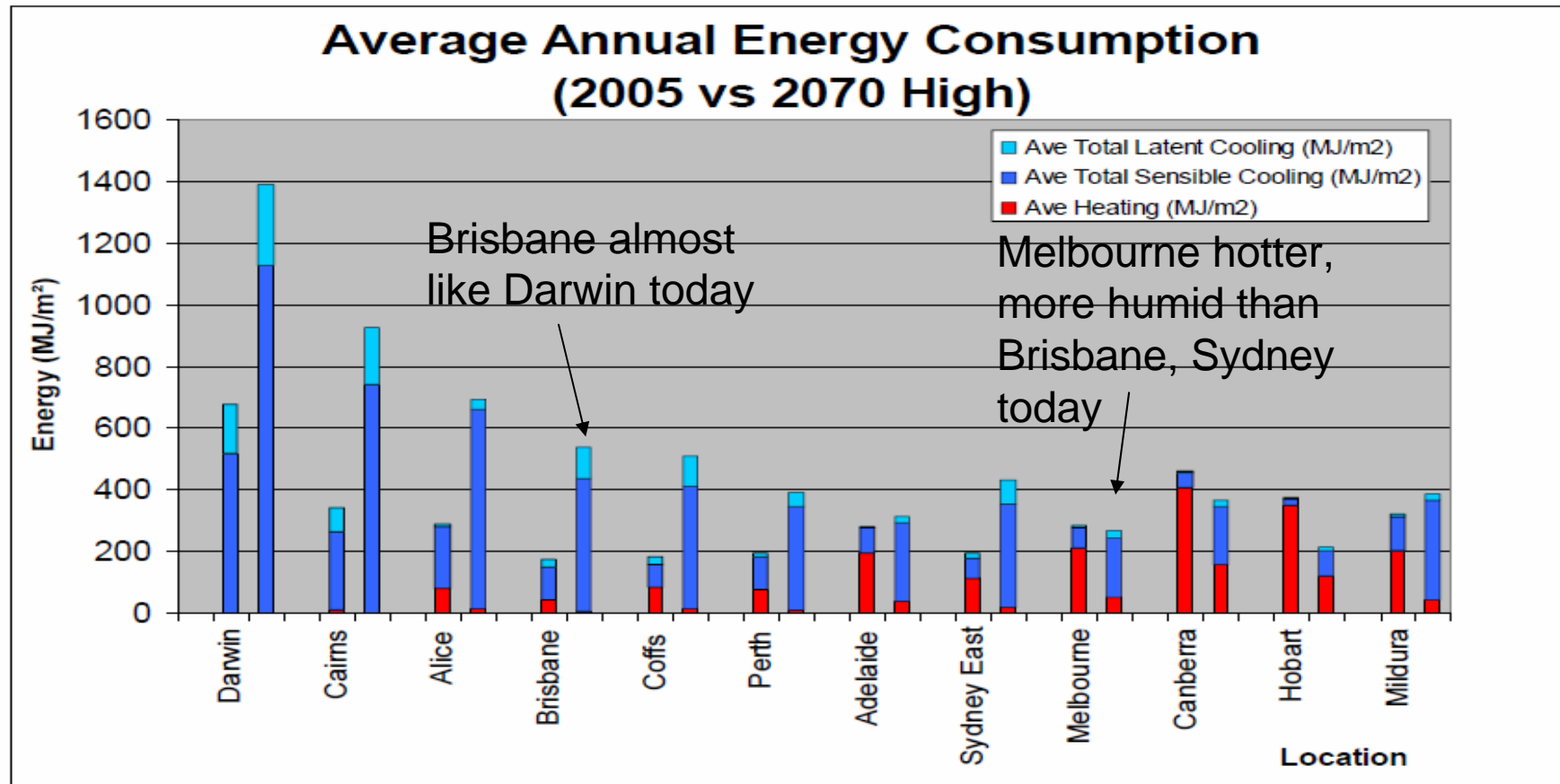
# Buildings Greenhouse Gas emissions



Data source: CIE estimates.

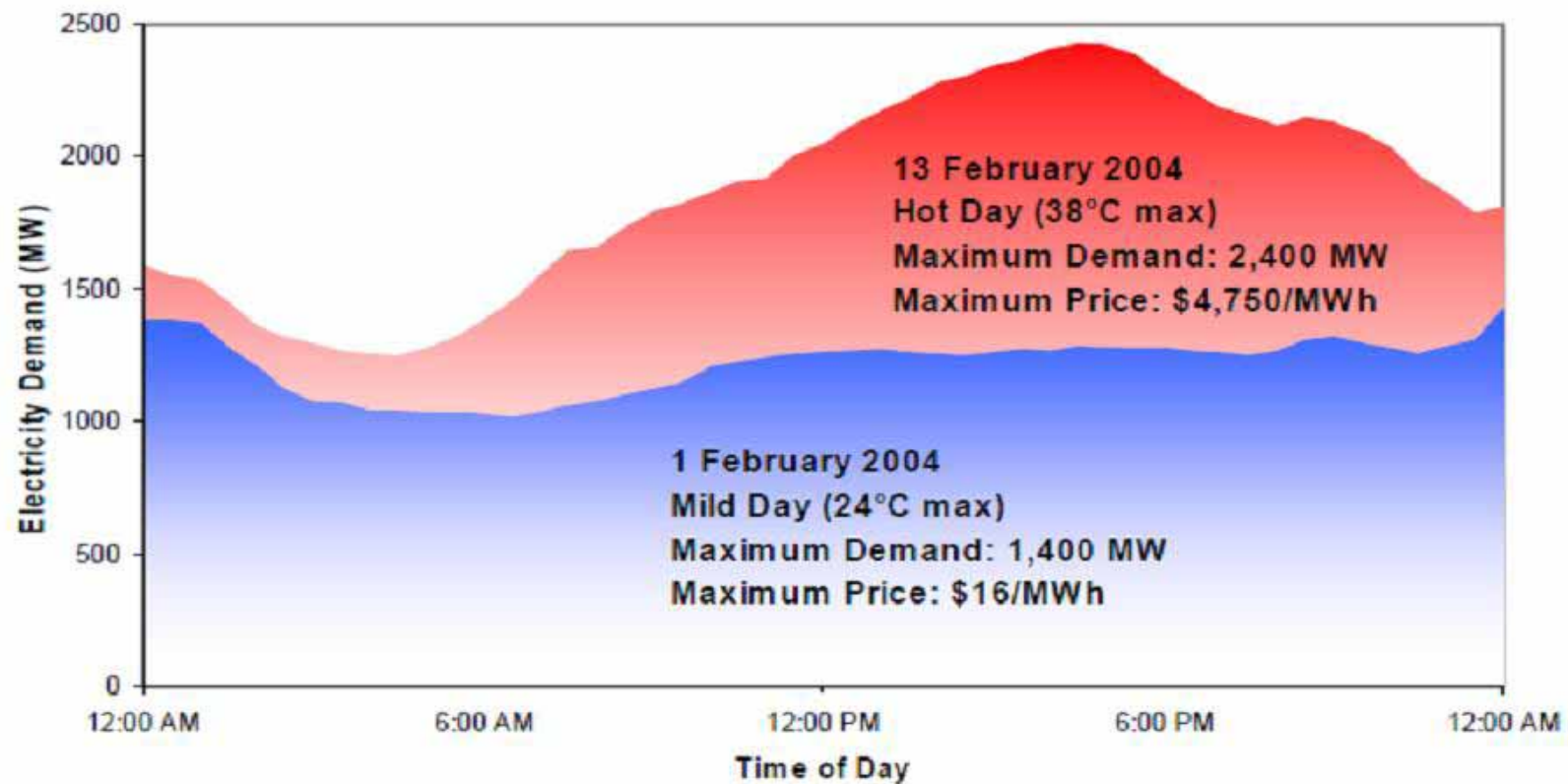
CIE (2009) *Review of the Proposed CPRS*

# Modelled impact of strong climate change – shift towards cooling (BRANZ, 2008)



Air conditioning is a major and growing contributor to summer peak electricity demand – and prices

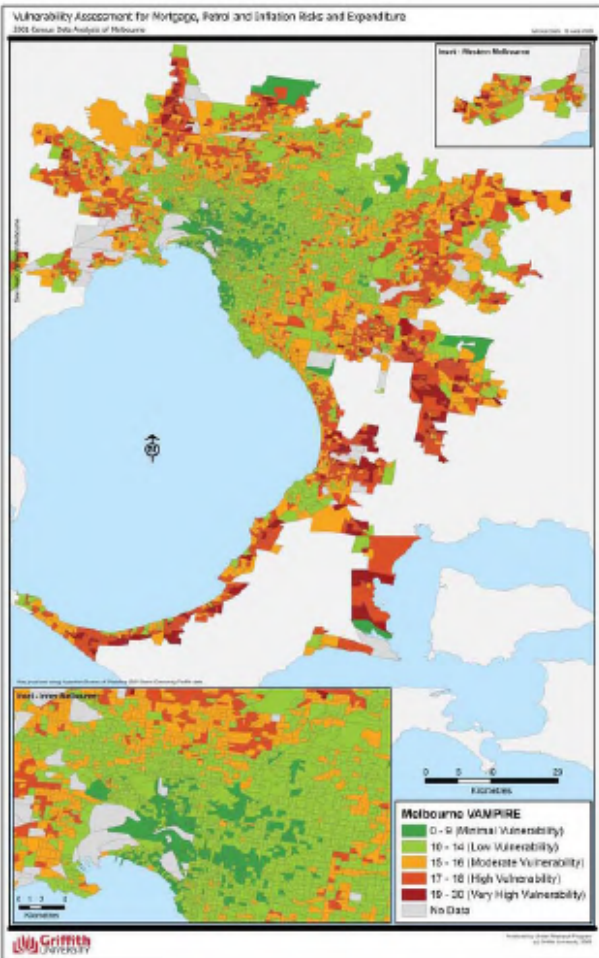
Figure 2: Electricity Demand and Price, South Australia



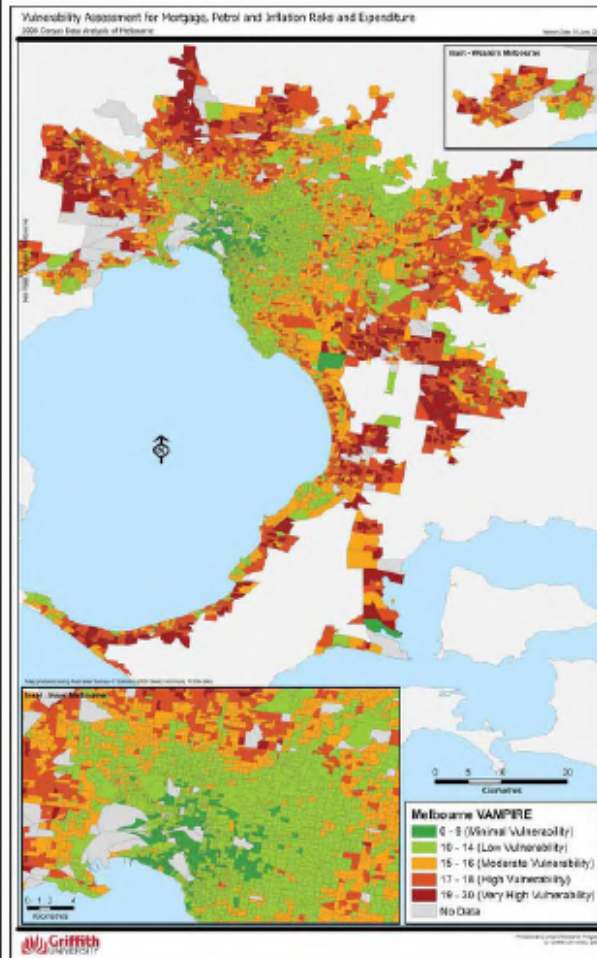
# Melbourne

Oil and Mortgage Vulnerability

2001



2006

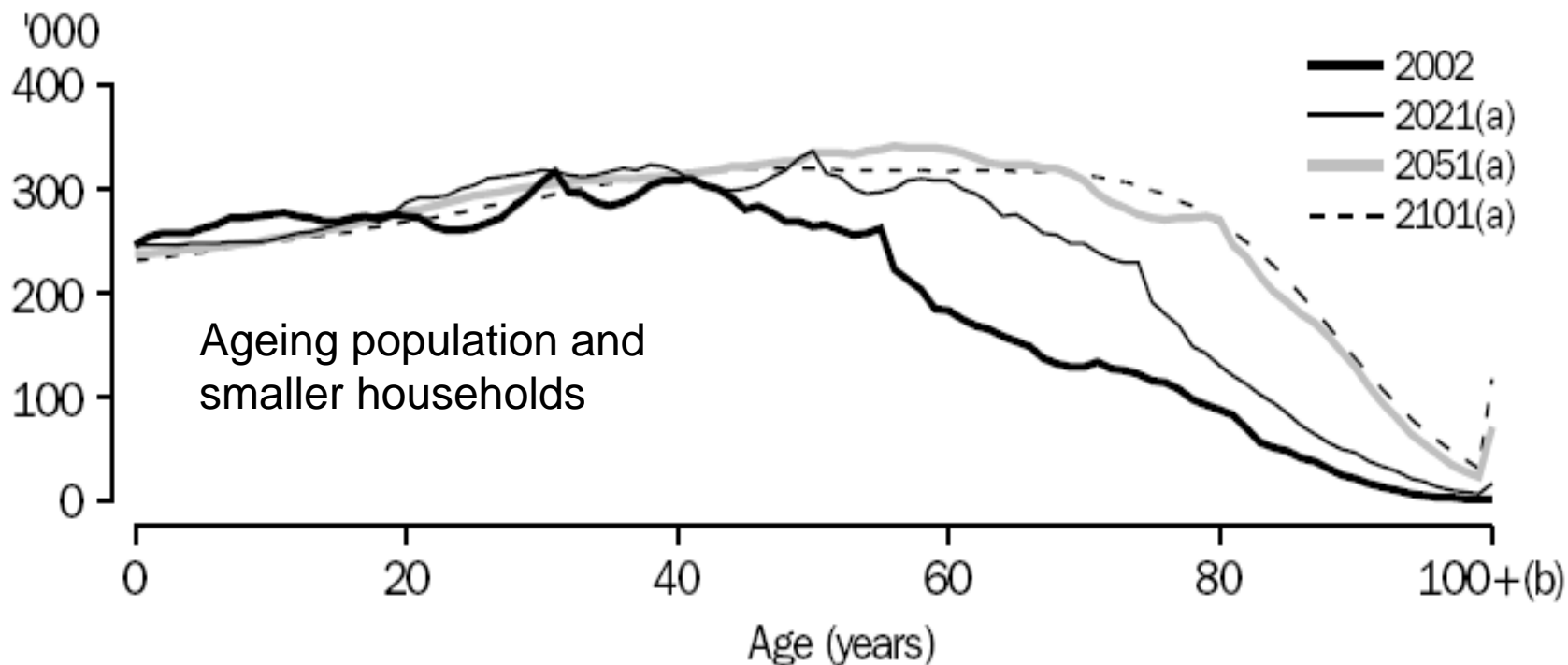


Vampire model results  
(Dodson et al)

Vulnerability to oil  
prices and interest  
rates

Need for extension of  
public transport and  
urban consolidation

### 5.13 AGE STRUCTURE OF THE PROJECTED POPULATION

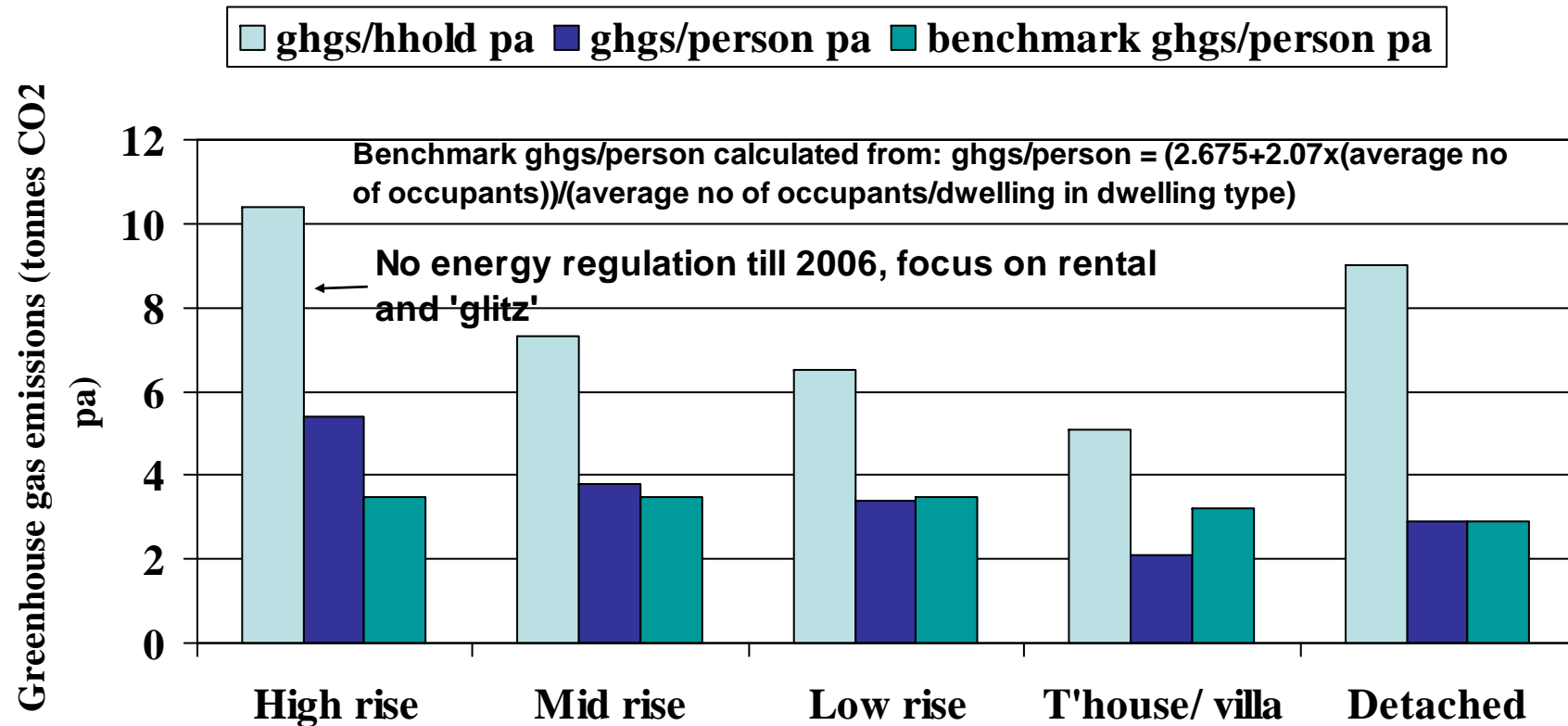


(a) Series B population projections. (b) The 100-years age group includes all ages 100 years and over and therefore is not strictly comparable with single year ages in the rest of the graph.

Source: *Population by Age and Sex, Australian States and Territories (3201.0)*; *Population Projections, Australia, 2002 to 2101 (3222.0)*.

# BASIX NSW study comparing dwelling types

(Myors, O'Leary and Helstroom, 2005)

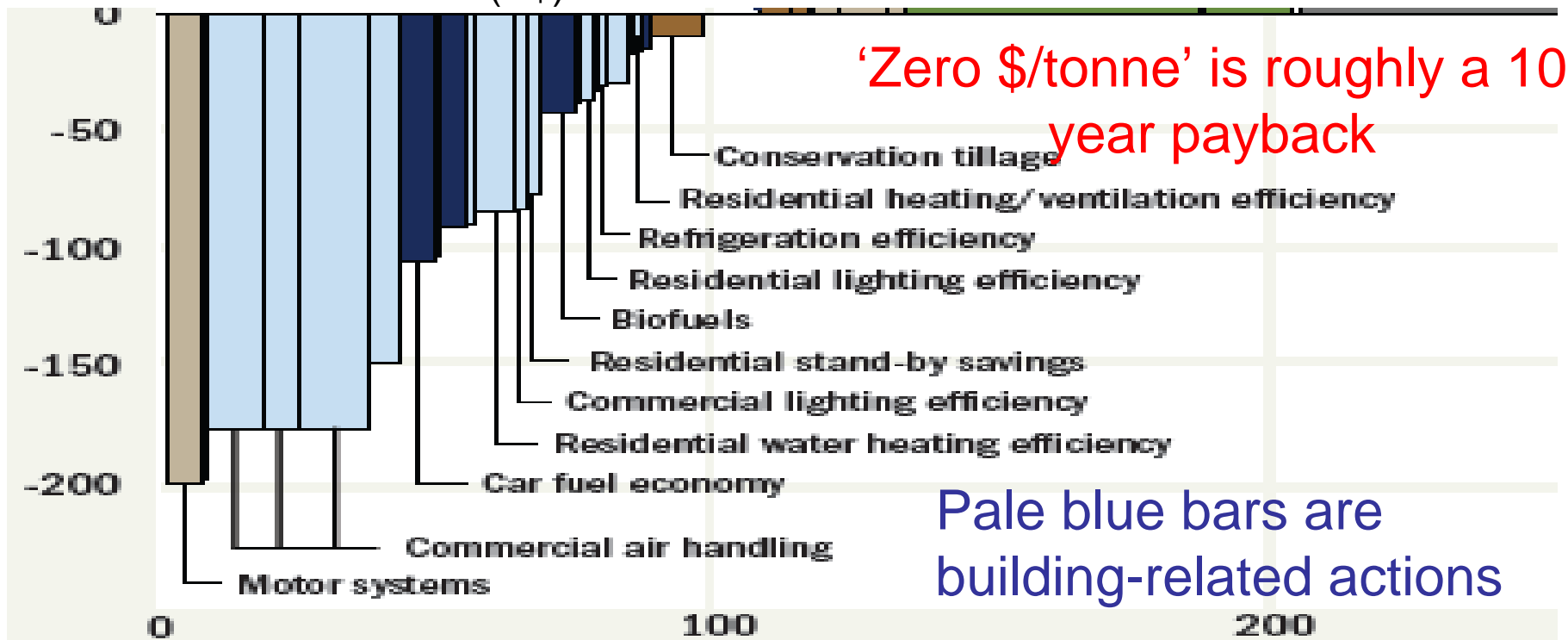


# Buildings, CPRS and Voluntary Abatement

- Few building developers, builders, building owners or occupants will be Liable Parties
  - Main effect: flow-on price impacts on energy and inputs of materials, goods and services
- Many building material, product suppliers will be LPs
  - Some will receive free permit allocations as Emission Intensive Trade Exposed Industries
  - Transitional price distortions due to EITE scheme
- Unless voluntary abatement is addressed, building energy efficiency and renewables will not deliver additional abatement (see [www.vcma.org.au](http://www.vcma.org.au))
- Some Government incentives from CPRS revenue to assist buildings abatement

# McKinsey (2008) emission abatement costs Australia to 2030

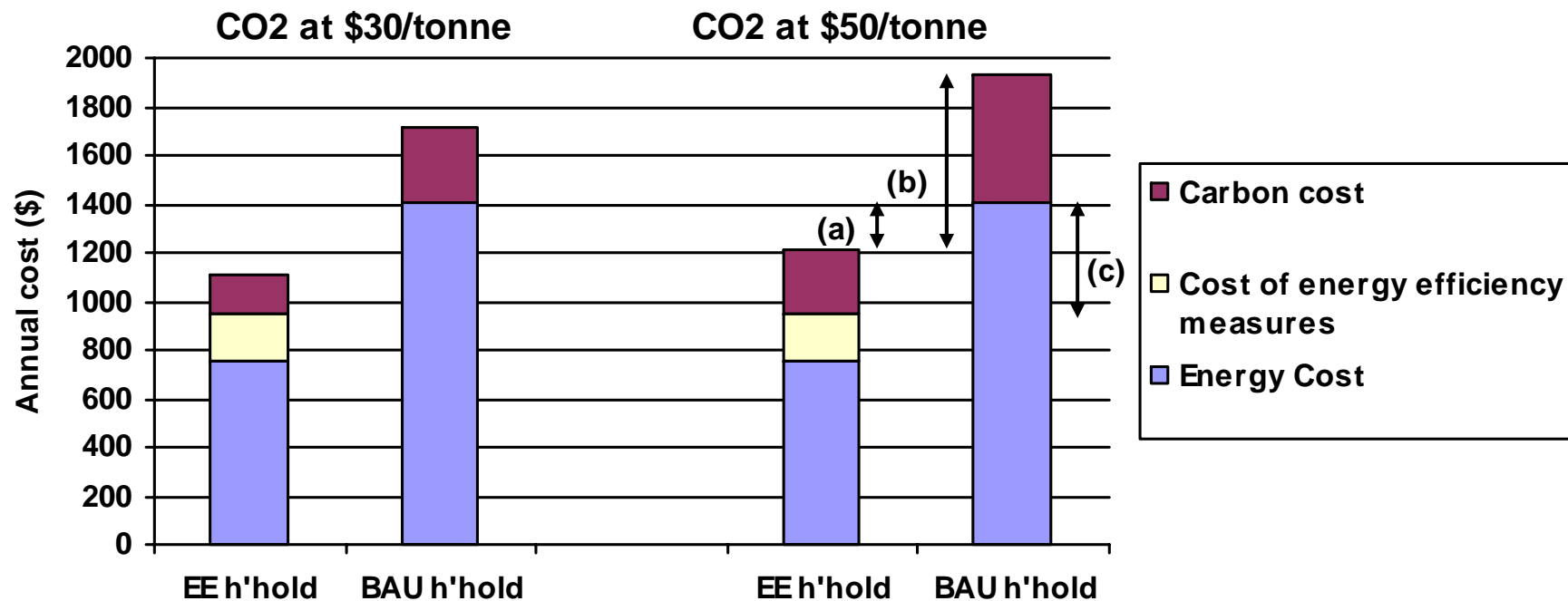
Cost/tonne CO2 avoided (A\$)



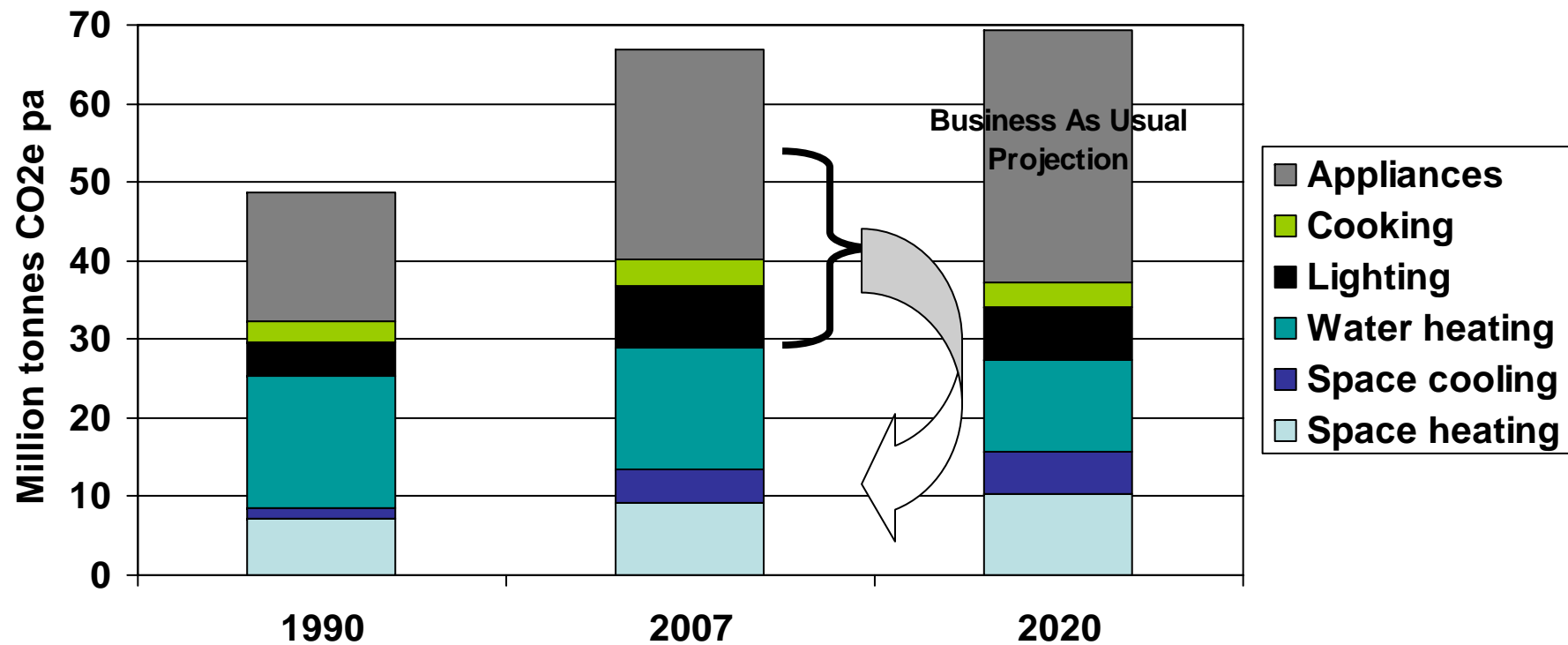
Note: Abatement opportunities are not additive to those of previous years  
Source: McKinsey Australia Climate Change Initiative

# Household energy savings for an efficient 'average' household: using less energy offsets higher price/unit

(from *Energy and Equity* ACF/ACOSS/Choice, 2008)

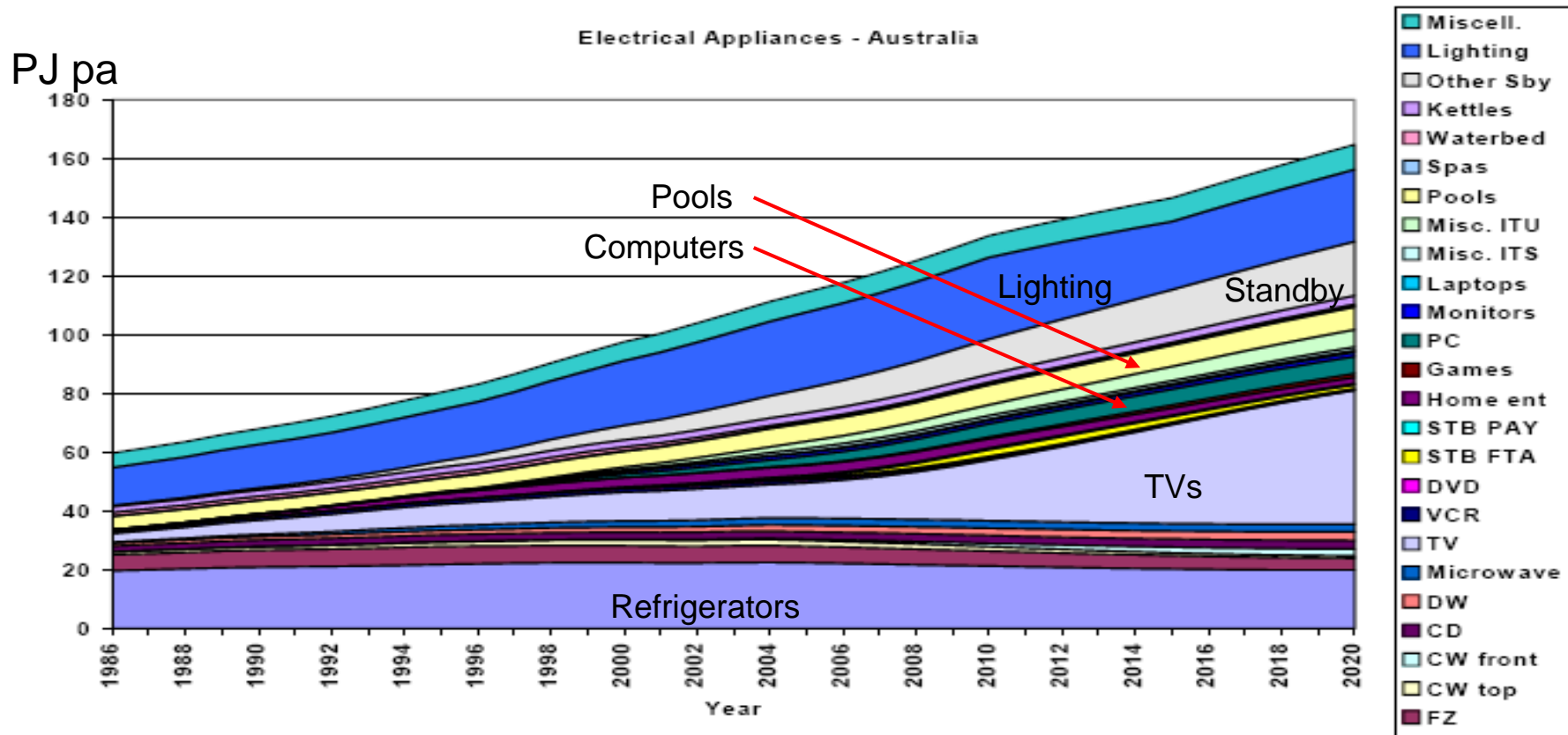


# Aust residential sector greenhouse gas emissions from energy use (from Holt 2008 and DECC GH Workbook 2008)

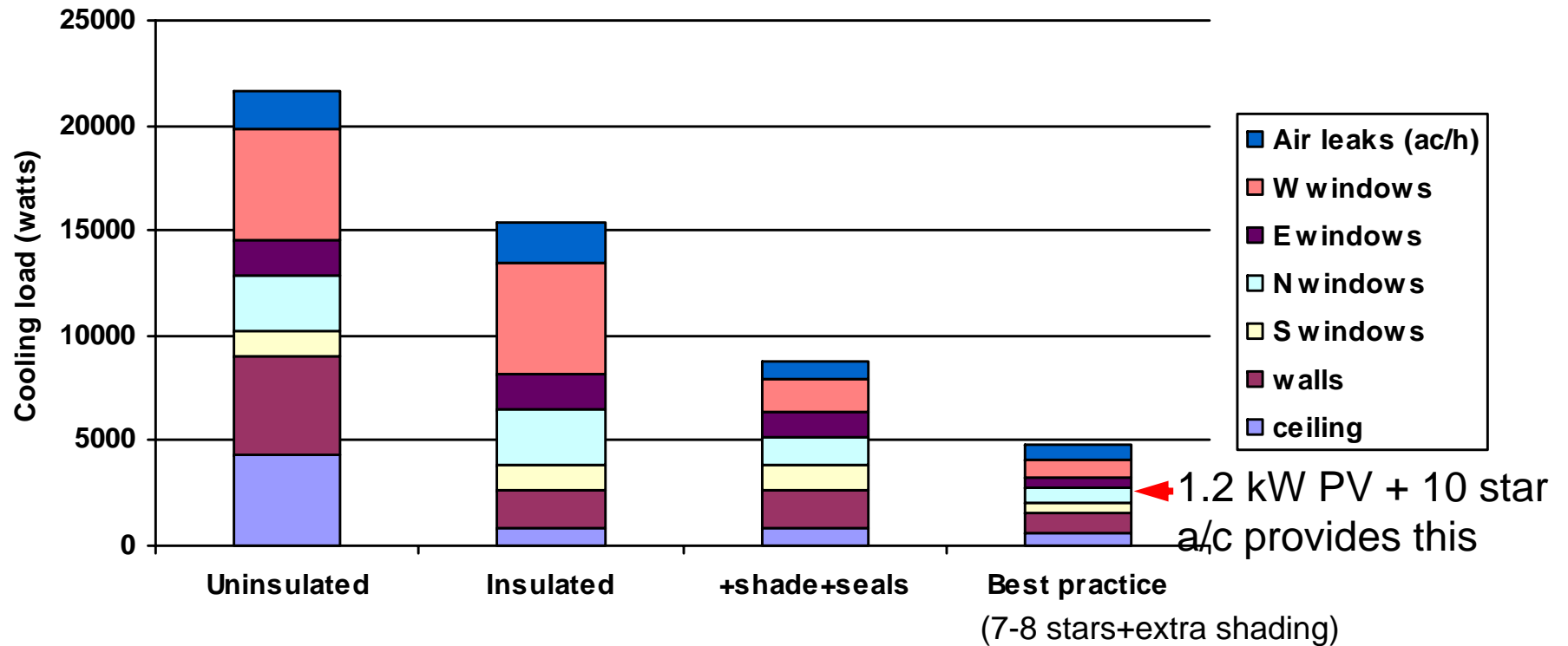


Projected Aust residential sector electricity use by appliances (Holt, 2008)

## Trends in Electric Appliances

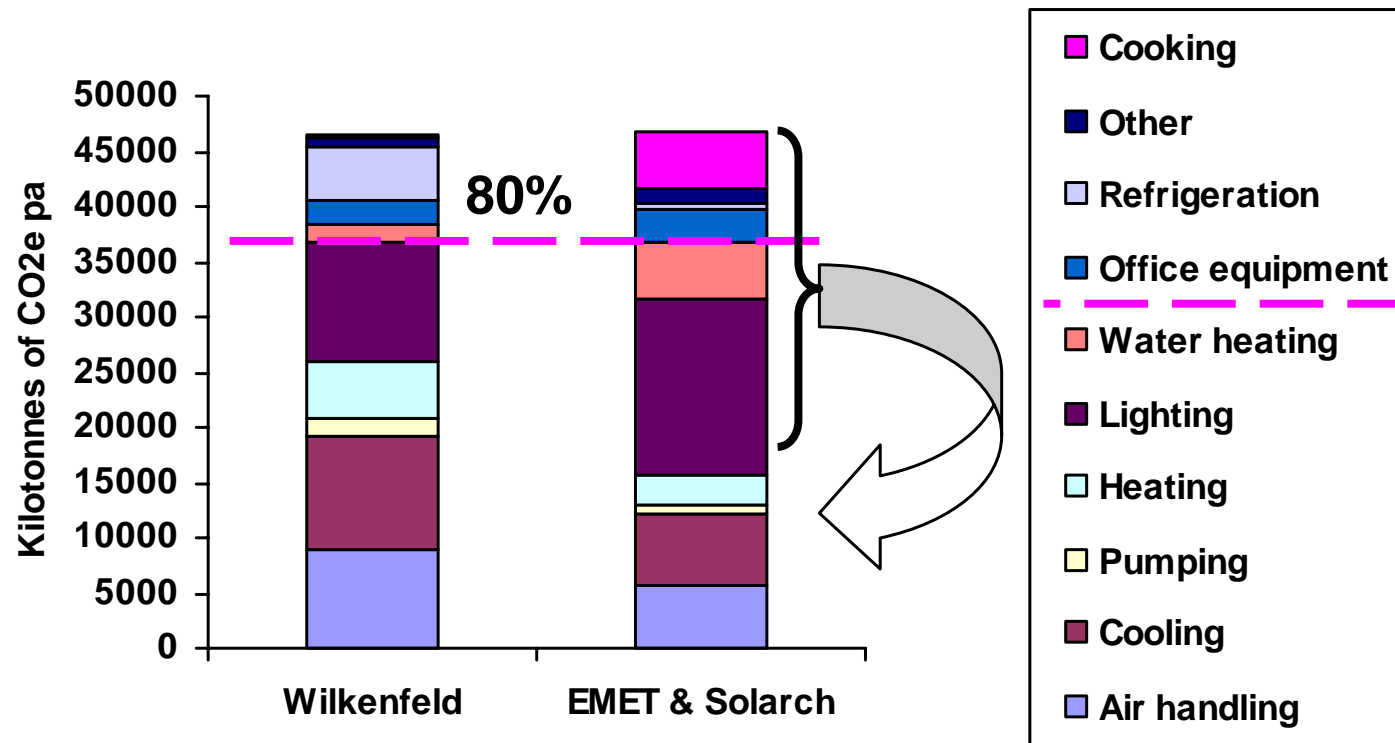


# Afternoon cooling requirements for a house on a very hot afternoon – cutting peak demand



# Commercial sector ghgs....

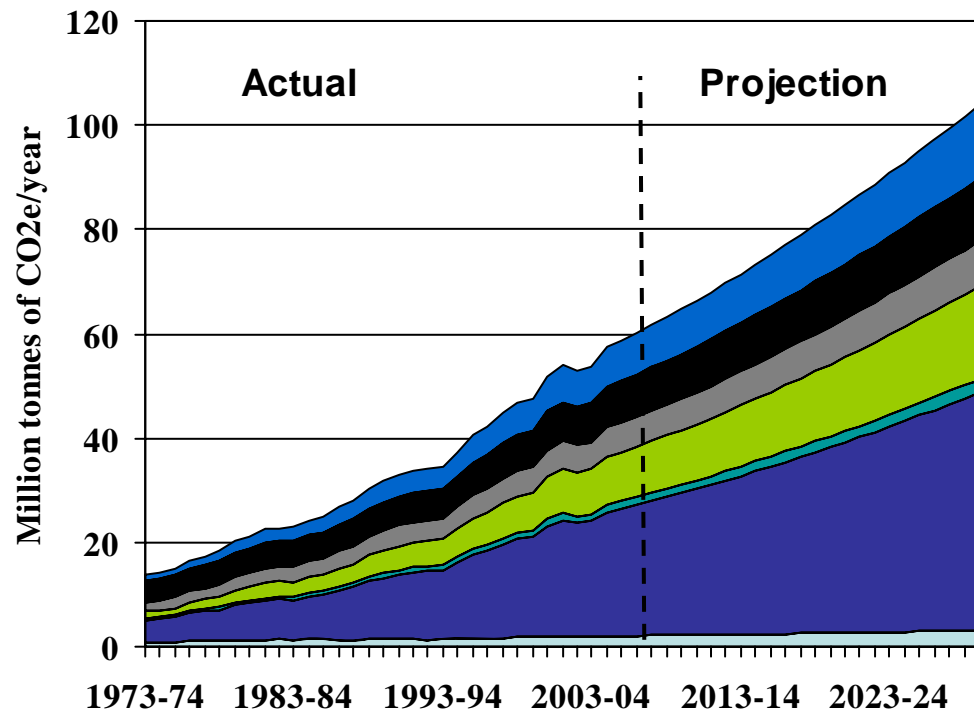
(from Wilkenfeld (2002) Table 8.8 for 1999 ghgs, EMET & Solarch (1999) for 1990 breakdown adjusted to 1999 total)



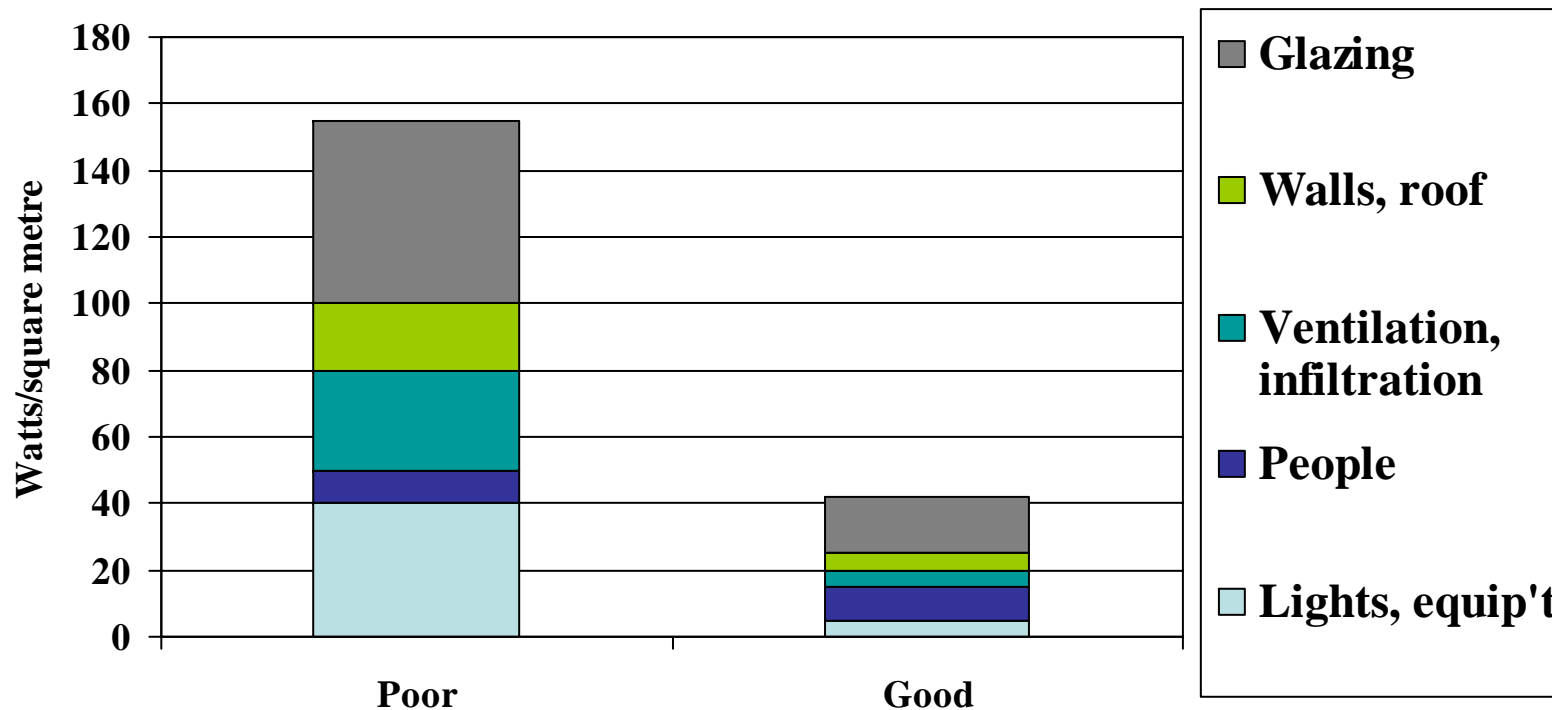
Key services: comfort; light; cleaning; food storage and preparation; computing; specialist tasks

# Australian commercial sector greenhouse gas emissions trends

(energy data ABARE, gh coefficients Aust Greenhouse Office, subsectoral projections based on 1990-2000 trends)



HVAC – contributions to peak cooling load for a 10,000 sq metre 10 storey building from envelope and internal loads.  
HVAC system efficiency also very significant



# Regulatory Trends (NSEE 2009)

- Increasing stringency from present weak levels:
  - 6-star residential 2010 (national implementation by 2011) + coverage of issues beyond fabric with 3-yearly review
  - Non-residential stringency increased from benefit:cost ratio of 5:1 to around 2:1
- Exploration of 'zero carbon' buildings
- Mandatory disclosure at resale or lease:
  - Residential from 2011
  - Non-residential phase-in from 2010
  - Drives accountability of developers, builders, designers
  - New focus on existing buildings – ACT experience
- ACCC focus on 'green' claims

# Future Regulatory Trends?

- Overall:
  - Lifetime perspective, precinct scale
  - Peak demand management
  - Incorporate infrastructure for smart energy systems
  - Integration with broader sustainability issues
  - Development of improved building rating and modelling tools and rating criteria
  - Benchmarking, feedback, accountability
- Residential – HVAC, cooking, clothes drying
- Non-residential – retail, internal thermal loads

# Other Possible Policy Tools, Programs

- Incentives: '2<sup>nd</sup> best' policy to compensate for energy market failures, split incentives, other distortions
- RDD&C funding for specific building projects, products, services, analytical tools, knowledge transfer, etc
- Existing buildings:
  - Diagnose waste – bills/energy use analysis, thermographic imaging, improved audits/assessments
  - Develop, deliver, reduce costs of retrofits – wall, duct and pipe insulation; seal air leaks; upgrade glazing; shading, etc
  - Target high energy users
  - Identify and replace inefficient and faulty equipment

# Building Industry Challenges

- Fragmentation and split incentives
- Design and marketing cultures
- Driving energy efficiency innovation
- ‘Constructive’ accountability for performance
- Upgrading existing building performance
- Managing winners and losers from CPRS, energy efficiency and other policy changes
  - Brick, concrete, timber
  - Low emission concrete, steel, bricks vs established suppliers

# Technology and Systems

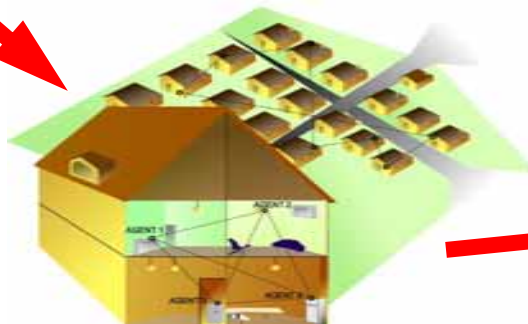
- Smart energy grids, demand management, distributed generation, precinct-scale systems
- Real-time monitoring, benchmarking, management
- Improved solar & gas HW, water efficiency
- Evacuated panel insulation, aerogels (translucent and opaque)
- Building surface reflectivity
- High efficiency heat pumps, air conditioners
- Solid state (eg LED), plasma lighting
- Switchable glazing, advanced coatings

# Energy production is a derived need, not an end in itself

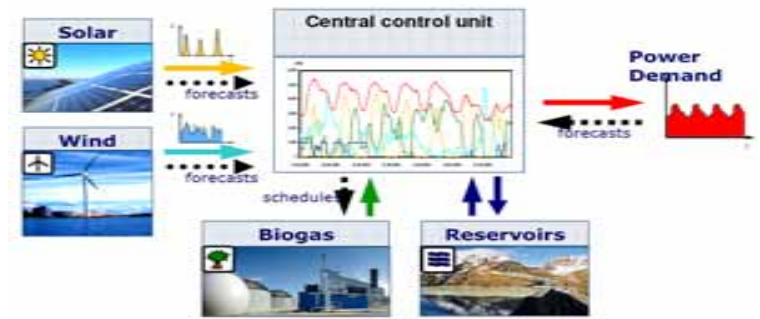
- Services:
- Shelter
- Nutrition
- Access
- Entertainment

Goods & services

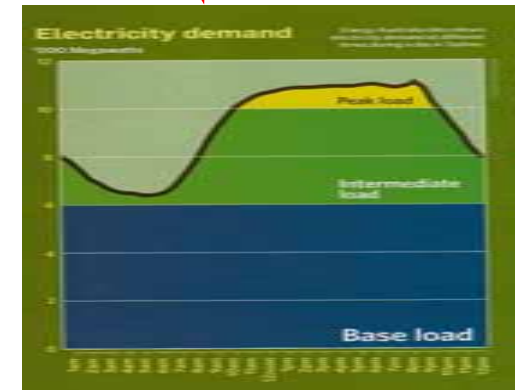
End-use technologies:  
types, efficiencies, usage



Energy production and supply



Demand for energy: type, amount and timing

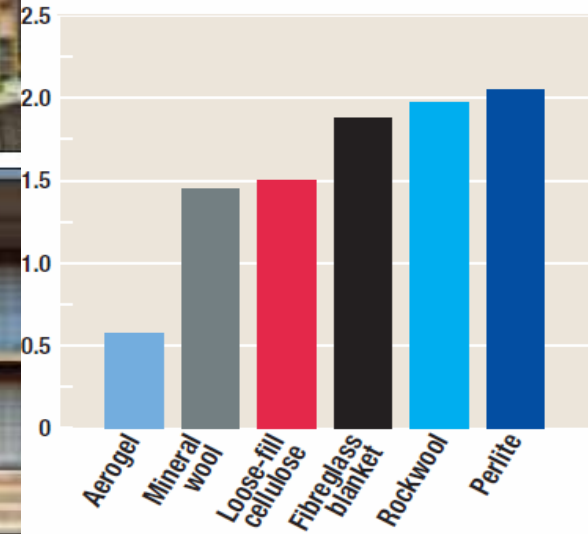


Silica aerogel – daylight and insulation  
25 mm aerogel=R1.5;  
double glazed low-e argon filled glazing=R0.5

[www.cabot-corp.com/nanogel](http://www.cabot-corp.com/nanogel)



Comparison of U-Values of 25 mm Thick Insulation Materials ( $W/m^2.K$ )





The End?